I/WE CLAIM:

1. A process for optical filter construction, the process comprising the steps of:

growing high index layers via a self-limiting deposition process chosen from the group comprising: atomic layer epitaxy, pulsed chemical beam epitaxy, molecular layer epitaxy, and laser molecular beam epitaxy;

growing low index layers;

depositing the high and low index layers onto a substrate;

monitoring, during deposition, the layer growth, the high index layer being monitored via reflection high energy electron diffraction, the low index layer being monitored via interferometric technique capable of sub-angstrom resolution;

monitoring intrinsic stress using an in-situ cantilever-based intrinsic stress optical monitor;

adjusting the intrinsic stress via deposition parameter modification;

monitoring indices of refraction during deposition via an in-situ ellipsometer;

measuring surface roughness using a reflection technique chosen from the group comprising: p-polarized reflection spectroscopy, phase modulated ellipsometry, and real-time atomic force microscopy;

depositing approximately a 1-10 nanometer thick first layer of amorphous diamond-like carbon onto the layer;

directing a well-focused oxygen ion beam onto the carbon coated layer at near grazing incidence;

rastering the ion beam in a sweeping fashion to allow interaction with only the carbon which protrudes above average surface height, the rastering being continued until a top layer of carbon is reduced to the level of the highest peaks in the layer; and,

repeating the process as necessary, alternating the high and low index layers.

2. A process for optical filter construction, the process comprising the steps of:

depositing at least one layer, the layer chosen from the group comprising high index and low index, onto a substrate;

monitoring layer growth;

monitoring intrinsic stress;

adjusting intrinsic stress, if necessary;

monitoring indices of refraction;

depositing amorphous carbon onto the at least one layer;

directing an ion beam onto the carbon coated layer; and,

reducing the carbon layer until the carbon layer is approximately atomically smooth.

3. The process of claim 2, wherein depositing at least one layer, the layer chosen from the group comprising high index and low index, onto a substrate comprises the step of :

depositing a high index layer onto a substrate.

4. The process of claim 3, wherein the process further comprises the steps of:

depositing a low index layer onto the carbon coated high index layer;

monitoring layer growth;

monitoring intrinsic stress;

adjusting intrinsic stress, if necessary;

monitoring indices of refraction;

depositing amorphous carbon onto the low index layer;

directing an ion beam onto the carbon coated low index layer; and,

reducing the carbon layer until the carbon layer is approximately atomically smooth.

5. The process of claim 4, wherein depositing at least one high index

layer onto a substrate comprises the step of:

depositing at least one high index layer, the layer chosen from the group comprising: titanium dioxide, amorphous silicon, and tantalum pentoxide, onto a fused silica substrate.

6. The process of claim 5, wherein depositing a low index layer onto the carbon coated high index layer comprises the step of:

depositing a low index layer, the layer chosen from the group comprising: silicon dioxide and magnesium fluoride, onto a fused silica substrate.

7. The process of claim 6, wherein monitoring layer growth comprises the step of:

monitoring, during deposition, the layer growth, the high index layer being monitored via reflection high energy electron diffraction, the low index layer being monitored via interferometric technique capable of sub-angstrom resolution.

8. The process of claim 7, wherein monitoring intrinsic stress comprises the step of:

monitoring intrinsic stress using an in-situ cantilever-based intrinsic stress optical monitor.

9. The process of claim 8, wherein adjusting intrinsic stress comprises the step of:

adjusting the intrinsic stress via deposition parameter modification.

10. The process of claim 9, wherein monitoring indices of refraction comprises the step of:

monitoring indices of refraction during deposition via an in-situ ellipsometer.

11. The process of claim 10, wherein after monitoring indices of refraction during deposition via an in-situ ellipsometer, the process comprises the step of:

measuring surface roughness using a reflection technique chosen from the group comprising: p-polarized reflection spectroscopy, phase modulated ellipsometry, and real-time atomic force microscopy.

12. The process of claim 11, wherein depositing amorphous carbon onto the at least one layer comprises the step of:

depositing approximately a 1-10 nanometer thick first layer of amorphous carbon onto the high index layer.

13. The process of claim 12, wherein directing an ion beam onto the carbon coated high index layer comprises the step of:

directing a well-focused oxygen ion beam onto the carbon coated high index layer at near grazing incidence.

14. The process of claim 13, wherein reducing the carbon layer until the carbon layer is approximately atomically smooth comprises the steps of:

rastering the ion beam in a sweeping fashion to allow interaction with only the carbon which protrudes above average surface height, the rastering being continued until a top layer of carbon is reduced to the level of the highest peaks in the layer.

15. The process of claim 4, wherein depositing amorphous carbon onto the low index layer comprises the step of:

depositing approximately a 1-10 nanometer thick second layer of amorphous carbon onto the low index layer.

16. The process of claim 15, wherein directing an ion beam onto the carbon coated low index layer comprises the step of:

directing a well-focused oxygen ion beam onto the carbon coated low index layer at near grazing incidence.

17. The process of claim 16, wherein reducing the carbon layer until the carbon layer is approximately atomically smooth comprises the steps of:

rastering the ion beam in a sweeping fashion to allow interaction with only the carbon which protrudes above average surface height, the rastering being continued until a top layer of carbon is reduced to the level of the highest peaks in the layer; and,

repeating the process as necessary, alternating the high and low index layers.

18. An optical filter constructed using the process of claim 2.

19. The process of claim 4, wherein the process further comprises the step of:

reducing the carbon layer until the surface roughness is approximately less than 0.1 nanometers.

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